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EXAMINER	
ROSENAU, DEREK JOHN	
ART UNIT	**PAPER NUMBER**
2834	

DATE MAILED: 06/27/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/518,435	RIPOLL, CHRISTOPHE	
	Examiner	Art Unit	
	Derek J. Rosenau	2834	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 28 April 2006.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 8-17 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 8-17 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 28 April 2006 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. The drawings were received on 4/28/2006. These drawings are accepted.

Specification

2. The disclosure is objected to because of the following informalities: In the amendments, "is positive and equal to +mE … activated by the computer. M represents … L_2 and L_1" should be "is positive and equal to +mE … activated by the computer, wherein m represents … L_2 and L_1" for consistency.

Appropriate correction is required.

Claim Objections

3. Claim 15 is objected to as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 15 does not define any structural elements, only method steps. Therefore, it is unclear whether applicant intends to claim an apparatus or a method.

4. Claim 11 is objected to because of the following informalities: it appears that the claim is intended to depend from claim 10 instead of claim 9. Appropriate correction is required.

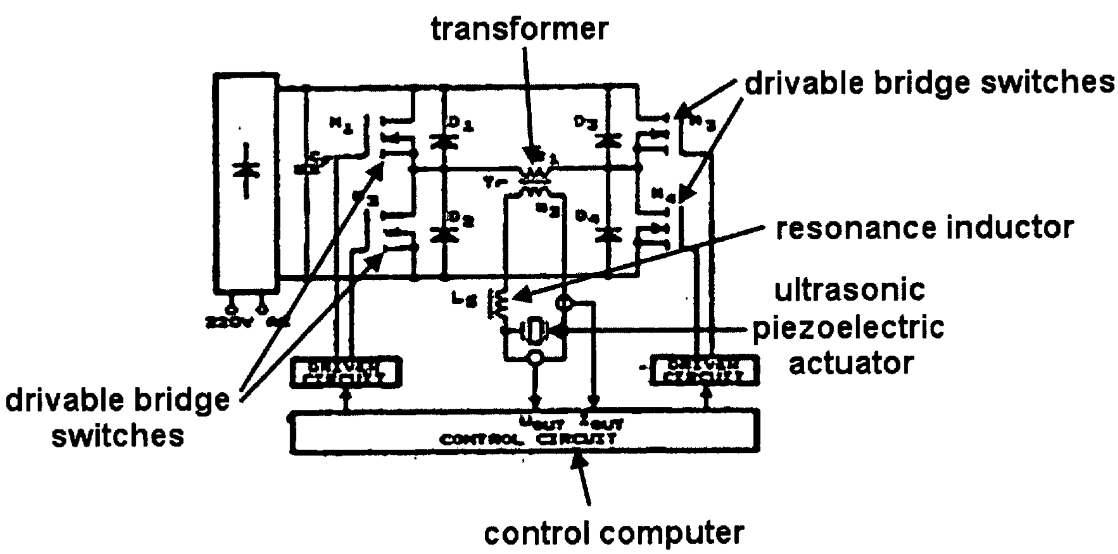
Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 8-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fabijanski (Reference AW, "Series Resonant Converter with Sandwich-Type Piezoelectric Ceramic Transducers", 6th European Conference on Power Electronics and Applications, pages 591-594, 1995) in view of Rueger et al. (US 7019436) in further view of Yamada et al. (US 5036263).

7. With respect to claim 8, Fabijanski discloses an apparatus (Fig 6) for electronic activation of a driver device configured to drive at least one ultrasonic piezoelectric actuator (see figure below) interfaced with a control computer (see figure below), said apparatus comprising: an AC-to-AC step-up voltage converter (see figure below, transformer), the high voltage output of which is connected to an oscillating circuit that includes an actuator (see figure below) and a resonance inductor (see figure below); the AC-to-AC converter includes at least one transformer (see figure below), the at least one transformer including at least one primary winding connected to the voltage source by at least one drivable switch (see figure below) and a second primary winding configured to deliver an AC signal for excitation of the actuator (see figure below).



Fabijanski does not disclose expressly a DC-to-AC converter configured to receive a DC voltage from a voltage source, or that a voltage across the terminals of the load comprising the transformer, resonance inductor and actuator is a signal with a specified chopping frequency, a current flowing in the load is a periodic signal of a resonance frequency such that a chopping frequency of the signal is smaller than twice the resonance frequency, and the at least one drivable switch is configured to close when the current flowing in the load is zero.

Rueger et al. teaches a piezoelectric device for a fuel injection system that includes a DC-to-AC converter configured to receive a DC voltage from a voltage source (item 7), the high voltage output of the DC-to-AC converter is connected to an oscillating circuit, the oscillating circuit includes an actuator (item 1) and a resonance inductor (item 2). Although Rueger does not discuss the presence of a DC-to-AC converter, the current through the load is an alternating current signal (as can be seen in Figs 11-14); therefore, as the voltage source is DC, Rueger et al. discloses a DC-to-AC converter. Rueger et al. also discloses that at least one drivable switch is configured to close when the current flowing in the load is zero (column 6, lines 3-6).

Yamada et al. teaches a piezoelectric actuator driving apparatus that includes a DC-to-AC step-up voltage converter configured to receive a DC voltage from a voltage source (item 1), the high output of the DC-to-AC voltage converter is connected to an oscillating circuit including an actuator (item 6) and a resonance inductor (item 7); the DC-to-AC converter includes at least one transformer (item 20), the at least one transformer including at least one primary winding connected to the voltage source by at least one drivable switch (item 22), and a secondary winding configured to deliver an AC signal for excitation of the actuator (Fig 1), wherein a voltage across the terminals of a load comprising the transformer, resonance inductor and

actuator is a signal with a specified chopping frequency (column 11, lines 10-15), and a current flowing in the load is a periodic signal of a resonance frequency (column 6, lines 14-20) such that a chopping frequency of the signal is smaller than twice the resonance frequency. Although Yamada et al. does not discuss the chopping frequency relative to the resonance frequency, it would be obvious to select the chopping frequency that would result in the appropriate amount of charging (column 11, lines 10-15).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to combine the zero current switching and DC-to-AC converter of Rueger et al. and the chopping frequency of Yamada et al. with the apparatus of Fabijanski for the benefits of providing a device that is easily usable in an automobile's electrical system (column 6, lines 42-48 of Rueger et al.) and to provide a device in which there is a greater degree of control in the amount of charging (column 11, lines 10-15).

8. With respect to claim 9, the combination of Fabijanski, Rueger et al., and Yamada et al. disclose the apparatus of claim 8. Fabijanski discloses that a zero current closing of the at least one switch is based on a transformation ratio of the transformer and of the resonance inductor determined as a function of an equivalent capacitance of the actuator (equations 13-15 and Fig 9).

9. With respect to claim 10, Fabijanski discloses an apparatus (Fig 6) for electronic activation of a driver device configured to drive at least one ultrasonic piezoelectric actuator (see figure above) interfaced with a control computer (see figure above), said apparatus comprising: an AC-to-AC step-up voltage converter (see figure above, transformer), the high voltage output of which is connected to an oscillating circuit that includes an actuator (see figure above) and a

resonance inductor (see figure above); the AC-to-AC converter includes at least one transformer (see figure above), the at least one transformer including at least one primary winding connected to the voltage source by at least one drivable switch (see figure above) and a second primary winding configured to deliver an AC signal for excitation of the actuator (see figure above). And a current flowing in the load is a periodic signal whose phase is advanced relative to the voltage across the terminals of the load (Fig 9).

Fabijanski does not disclose expressly a DC-to-AC converter configured to receive a DC voltage from a voltage source, or that a voltage across the terminals of the load comprising the transformer, resonance inductor and actuator is a signal with a specified chopping frequency, that the resonance frequency of the current is such that a chopping frequency of the signal lies between half and twice the resonance frequency, and the at least one drivable switch is configured to close when the current flowing in the load is zero.

Rueger et al. teaches a piezoelectric device for a fuel injection system that includes a DC-to-AC converter configured to receive a DC voltage from a voltage source (item 7), the high voltage output of the DC-to-AC converter is connected to an oscillating circuit, the oscillating circuit includes an actuator (item 1) and a resonance inductor (item 2). Although Rueger does not discuss the presence of a DC-to-AC converter, the current through the load is an alternating current signal (as can be seen in Figs 11-14); therefore, as the voltage source is DC, Rueger et al. discloses a DC-to-AC converter. Rueger et al. also discloses that at least one drivable switch is configured to close when the current flowing in the load is zero (column 6, lines 3-6).

Yamada et al. teaches a piezoelectric actuator driving apparatus that includes a DC-to-AC step-up voltage converter configured to receive a DC voltage from a voltage source (item 1), the

high output of the DC-to-AC voltage converter is connected to an oscillating circuit including an actuator (item 6) and a resonance inductor (item 7); the DC-to-AC converter includes at least one transformer (item 20), the at least one transformer including at least one primary winding connected to the voltage source by at least one drivable switch (item 22), and a secondary winding configured to deliver an AC signal for excitation of the actuator (Fig 1), wherein a voltage across the terminals of a load comprising the transformer, resonance inductor and actuator is a signal with a specified chopping frequency (column 11, lines 10-15), and a current flowing in the load is a periodic signal of a resonance frequency (column 6, lines 14-20) such that a chopping frequency of the signal is between half and twice the resonance frequency. Although Yamada et al. does not discuss the chopping frequency relative to the resonance frequency, it would be obvious to select the chopping frequency that would result in the appropriate amount of charging (column 11, lines 10-15).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to combine the zero current switching and DC-to-AC converter of Rueger et al. and the chopping frequency of Yamada et al. with the apparatus of Fabijanski for the benefits of providing a device that is easily usable in an automobile's electrical system (column 6, lines 42-48 of Rueger et al.) and to provide a device in which there is a

10. With respect to claim 11, the combination of Fabijanski, Rueger et al., and Yamada et al. disclose the apparatus of claim 10. Fabijanski discloses that a zero current closing of the at least one switch is based on a transformation ratio of the transformer and of the resonance inductor determined as a function of an equivalent capacitance of the actuator (equations 13-15 and Fig 9).

11. With respect to claim 12, Fabijanski discloses an apparatus (Fig 6) for electronic activation of a driver device configured to drive at least one ultrasonic piezoelectric actuator (see figure above) interfaced with a control computer (see figure above), said apparatus comprising: an AC-to-AC step-up voltage converter (see figure above, transformer), the high voltage output of which is connected to an oscillating circuit that includes an actuator (see figure above) and a resonance inductor (see figure above); the AC-to-AC converter includes at least one transformer (see figure above), the at least one transformer including at least one primary winding connected to the voltage source by at least one drivable switch (see figure above) and a second primary winding configured to deliver an AC signal for excitation of the actuator (see figure above). And a current flowing in the load is a periodic signal whose phase is retarded relative to the voltage across the terminals of the load (Fig 9).

Fabijanski does not disclose expressly a DC-to-AC converter configured to receive a DC voltage from a voltage source, or that a voltage across the terminals of the load comprising the transformer, resonance inductor and actuator is a signal with a specified chopping frequency, that the resonance frequency of the current is such that a chopping frequency of the signal is greater than half the resonance frequency, and the at least one drivable switch is configured to close when the current flowing in the load is zero.

Rueger et al. teaches a piezoelectric device for a fuel injection system that includes a DC-to-AC converter configured to receive a DC voltage from a voltage source (item 7), the high voltage output of the DC-to-AC converter is connected to an oscillating circuit, the oscillating circuit includes an actuator (item 1) and a resonance inductor (item 2). Although Rueger does not discuss the presence of a DC-to-AC converter, the current through the load is an alternating

current signal (as can be seen in Figs 11-14); therefore, as the voltage source is DC, Rueger et al. discloses a DC-to-AC converter. Rueger et al. also discloses that at least one drivable switch is configured to close when the current flowing in the load is zero (column 6, lines 3-6).

Yamada et al. teaches a piezoelectric actuator driving apparatus that includes a DC-to-AC step-up voltage converter configured to receive a DC voltage from a voltage source (item 1), the high output of the DC-to-AC voltage converter is connected to an oscillating circuit including an actuator (item 6) and a resonance inductor (item 7); the DC-to-AC converter includes at least one transformer (item 20), the at least one transformer including at least one primary winding connected to the voltage source by at least one drivable switch (item 22), and a secondary winding configured to deliver an AC signal for excitation of the actuator (Fig 1), wherein a voltage across the terminals of a load comprising the transformer, resonance inductor and actuator is a signal with a specified chopping frequency (column 11, lines 10-15), and a current flowing in the load is a periodic signal of a resonance frequency (column 6, lines 14-20) such that a chopping frequency of the signal is greater than half the resonance frequency. Although Yamada et al. does not discuss the chopping frequency relative to the resonance frequency, it would be obvious to select the chopping frequency that would result in the appropriate amount of charging (column 11, lines 10-15).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to combine the zero current switching and DC-to-AC converter of Rueger et al. and the chopping frequency of Yamada et al. with the apparatus of Fabijanski for the benefits of providing a device that is easily usable in an automobile's electrical system (column 6, lines 42-48 of Rueger et al.) and to provide a device in which there is a

12. With respect to claim 13, the combination of Fabijanski, Rueger et al., and Yamada et al. disclose the apparatus of claim 12. Fabijanski discloses that a zero current closing of the at least one switch is based on a transformation ratio of the transformer and of the resonance inductor determined as a function of an equivalent capacitance of the actuator (equations 13-15 and Fig 9).

13. With respect to claim 14, the combination of Fabijanski, Rueger et al., and Yamada et al. disclose the apparatus of claim 8. Fabijanski discloses that the converter is configured to include a bridge circuit (Fig 6) containing the at least one transformer having at least one primary winding (see figure above), the bridge circuit being established from a first arm composed of two alternately drivable bridge switches connected in series (see figure above) and of at last one second arm parallel with the first arm and also being composed of two alternately drivable bridge switches connected in series (see figure above), a center point of the second arm being connected to a center point of the first arm by the load composed of the transformer, resonance inductor, and actuator (see figure above); each bridge switch including a diode and a transistor (Fig 6); the bridge switches are configured to be activated in phases, a first phase including … configured to be in an open position. While Fabijanski does not discuss the specifics of the timing of opening and closing the switches of the apparatus of Fig 6, the claimed timing sequence of claim 14 does not define structure, and the device of Fabijanski is capable of performing the timing sequence as claimed in claim 14. Additionally, the timing sequence provided would have been obvious to a person of ordinary skill in the art, given its intended use with fuel injectors in an internal combustion engine. The operation of an internal combustion engine requires a very precise sequence of events to occur at the correct times. The activating of the fuel injectors is a very

important part of this sequence of events. Therefore, the claimed timing sequence of claim 14 would have been obvious to a person of ordinary skill in the art in order to ensure the correct operation of the engine.

14. With respect to claim 15, the combination of Fabijanski, Rueger et al., and Yamada et al. discloses the apparatus of claim 14. As discussed above, Fabijanski does not discuss the specifics of the timing of the opening and closing of the switches of the apparatus of Fig 6. Also, as discussed for claim 14 above, this timing sequence would be obvious to a person of ordinary skill in the art given its intended use for fuel injectors in an internal combustion engine. Therefore, in order to use the device continually, it would have been obvious to a person of ordinary skill in the art to repeat the timing sequence of claim 14.

15. With respect to claim 16, the combination of Fabijanski, Rueger et al., and Yamada et al. disclose the apparatus of claim 10. Fabijanski discloses that the converter is configured to include a bridge circuit (Fig 6) containing the at least one transformer having at least one primary winding (see figure above), the bridge circuit being established from a first arm composed of two alternately drivable bridge switches connected in series (see figure above) and of at last one second arm parallel with the first arm and also being composed of two alternately drivable bridge switches connected in series (see figure above), a center point of the second arm being connected to a center point of the first arm by the load composed of the transformer, resonance inductor, and actuator (see figure above); each bridge switch including a diode and a transistor (Fig 6); the bridge switches are configured to be activated in phases, a first phase including … configured to be in an open position. While Fabijanski does not discuss the specifics of the timing of opening and closing the switches of the apparatus of Fig 6, the claimed timing sequence of claim 16 does

not define structure, and the device of Fabijanski is capable of performing the timing sequence as claimed in claim 16. Additionally, the timing sequence provided would have been obvious to a person of ordinary skill in the art, given its intended use with fuel injectors in an internal combustion engine. The operation of an internal combustion engine requires a very precise sequence of events to occur at the correct times. The activating of the fuel injectors is a very important part of this sequence of events. Therefore, the claimed timing sequence of claim 16 would have been obvious to a person of ordinary skill in the art in order to ensure the correct operation of the engine.

16. With respect to claim 17, the combination of Fabijanski, Rueger et al., and Yamada et al. disclose the apparatus of claim 12. Fabijanski discloses that the converter is configured to include a bridge circuit (Fig 6) containing the at least one transformer having at least one primary winding (see figure above), the bridge circuit being established from a first arm composed of two alternately drivable bridge switches connected in series (see figure above) and of at last one second arm parallel with the first arm and also being composed of two alternately drivable bridge switches connected in series (see figure above), a center point of the second arm being connected to a center point of the first arm by the load composed of the transformer, resonance inductor, and actuator (see figure above); each bridge switch including a diode and a transistor (Fig 6); the bridge switches are configured to be activated in phases, a first phase including … configured to be in an open position. While Fabijanski does not discuss the specifics of the timing of opening and closing the switches of the apparatus of Fig 6, the claimed timing sequence of claim 17 does not define structure, and the device of Fabijanski is capable of performing the timing sequence as claimed in claim 17. Additionally, the timing sequence provided would have been obvious to a

person of ordinary skill in the art, given its intended use with fuel injectors in an internal combustion engine. The operation of an internal combustion engine requires a very precise sequence of events to occur at the correct times. The activating of the fuel injectors is a very important part of this sequence of events. Therefore, the claimed timing sequence of claim 17 would have been obvious to a person of ordinary skill in the art in order to ensure the correct operation of the engine.

Response to Arguments

17. Applicant's arguments with respect to claims 1-7 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

18. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Derek J. Rosenau whose telephone number is 571-272-8932. The examiner can normally be reached on Monday thru Friday 8:00-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Darren Schuberg can be reached on 571-272-2044. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Derek J Rosenau
Examiner
Art Unit 2834

DJR
6/13/06

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